Chapter 4

Fossil Fuels: Petroleum, Natural Gas and Coal

How did fossil fuels get their name?

Petroleum, natural gas and coal are known as fossil fuels. They got this name because rocks where these fuels are found often contain imprints of ancient plants and animals known as fossils. When we mine coal and drill for petroleum and natural gas, we are reminded that these energy resources are a part of history.

The Nature of Fossil Fuels

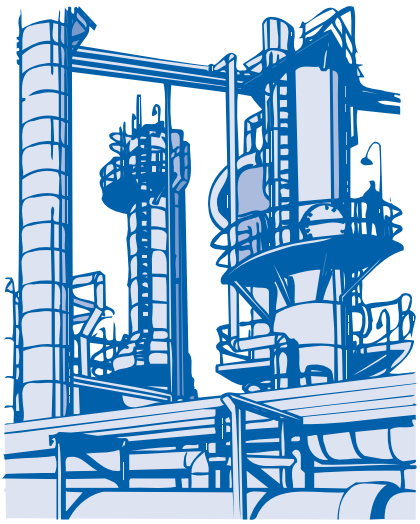
Two features distinguish fossil fuels. First, they are *organic*. This means they originally came from living things. Nature slowly turns plant and animal remains into the fuels we know as petroleum, natural gas and coal.

Second, fossil fuels are *nonrenewable*. By this we mean that supplies are limited. Once the fossil fuels we now have are used up, we will not be able to quickly obtain more.

You may be wondering if the plants and animals around today can be used to form new petroleum, natural gas and coal? In fact, they can. However, the process of forming these fuels takes millions of years. During our lifetime, our energy needs will have to be met by those fossil fuels we already have at hand.

The Role of Fossil Fuels in American Life

Realizing that our supplies of fossil fuels are limited should make us all stop and think. We are a nation of fossil fuel users. Fossil fuels run our cars and planes. They operate our factories and mills. They are used to cook much of our food and heat many of our homes. Fossil fuels provide 85.6 percent of all the energy used in the U.S. Without fossil fuels, the American way of life would not exist as it does today.



In South Carolina, we use somewhat less fossil fuels than the nation as a whole. Still, nearly two-thirds of our energy needs are provided by fossil fuels. Moreover, since no fossil fuels are found here, they have to be brought into the state. This adds to the cost of fossil fuels in South Carolina.

Petroleum

Petroleum is the world's most popular energy resource. In the U.S., petroleum alone accounts for nearly half of the energy we use. It is in such high demand it is known as "black gold."

How We Get Petroleum

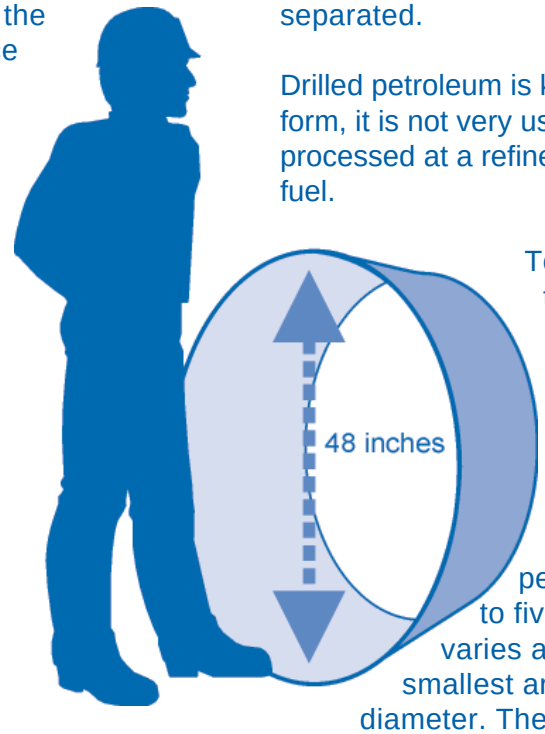
Like all fossil fuels, petroleum began as living matter. It is formed from the remains of tiny sea plants and animals known as plankton. Millions

of years ago, plankton settled to the bottom of shallow seas. Sand and mud covered the decaying plankton. Pressure and heat slowly turned the plankton into the hydrogen and carbon substance we know as petroleum.

Most petroleum is found deep below the earth's surface. To reach it, sophisticated drilling procedures are used. First, a test well is drilled to make sure oil is present. If oil is found, a drilling rig is then set up. Tall derricks, like the one shown below, contain drilling equipment.

Petroleum can also be found beneath the ocean floor. If waters are shallow, a rig is set up on a platform that rests on the ocean bottom. In the open sea, floating rigs are built.

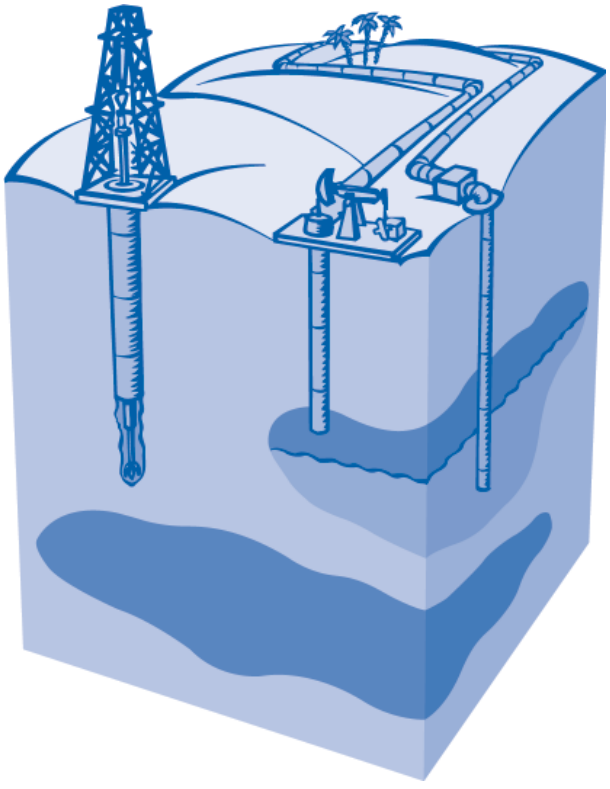
Despite the way it may look on TV or in the movies, drilling is a complex procedure. Water and natural gas are brought to the surface along with petroleum. The water must be removed. Natural gas and petroleum need to be separated.



Drilled petroleum is known as *crude oil*. In this form, it is not very useful. The crude oil must be processed at a refinery before it can be used as fuel.

To transport petroleum from the drilling areas to refineries, tankers or pipelines are used. Tankers carry petroleum across oceans. Pipelines move it over land.

Pipelines are built to move petroleum at a speed of three to five miles an hour. Their size varies according to need. The smallest are only two inches in diameter. The largest, such as the Trans-Alaskan pipeline, are 48 inches across. To give you a better idea of size, the drawing above shows a person next to a pipeline that is the same diameter as the Trans-Alaskan pipeline.



At the refinery, crude oil is *distilled*, or boiled. This separates it into a number of energy fuels: gasoline, jet fuel, heating fuel, diesel fuel and kerosene.

A small amount of crude oil is used to produce non-energy related materials known as *petrochemicals*. These chemical materials are used in making many familiar products. Does it surprise you that paint, vitamins and camera film are all made from petroleum?

The distilled petroleum fuels are once more moved out of the refineries by pipelines. Large customers may have fuels piped directly to them. Typically, the fuel is piped to storage areas known as *bulk terminals*. Trucks and railway cars then carry the fuel to oil dealers and gasoline service stations, from whom consumers purchase the fuels they need.

South Carolina's Petroleum Supply

Most petroleum in the U.S. is found in the states of Alaska, Oklahoma, Texas, and Louisiana. Twenty-seven other states also produce petroleum. South Carolina is not among these oil-rich states.

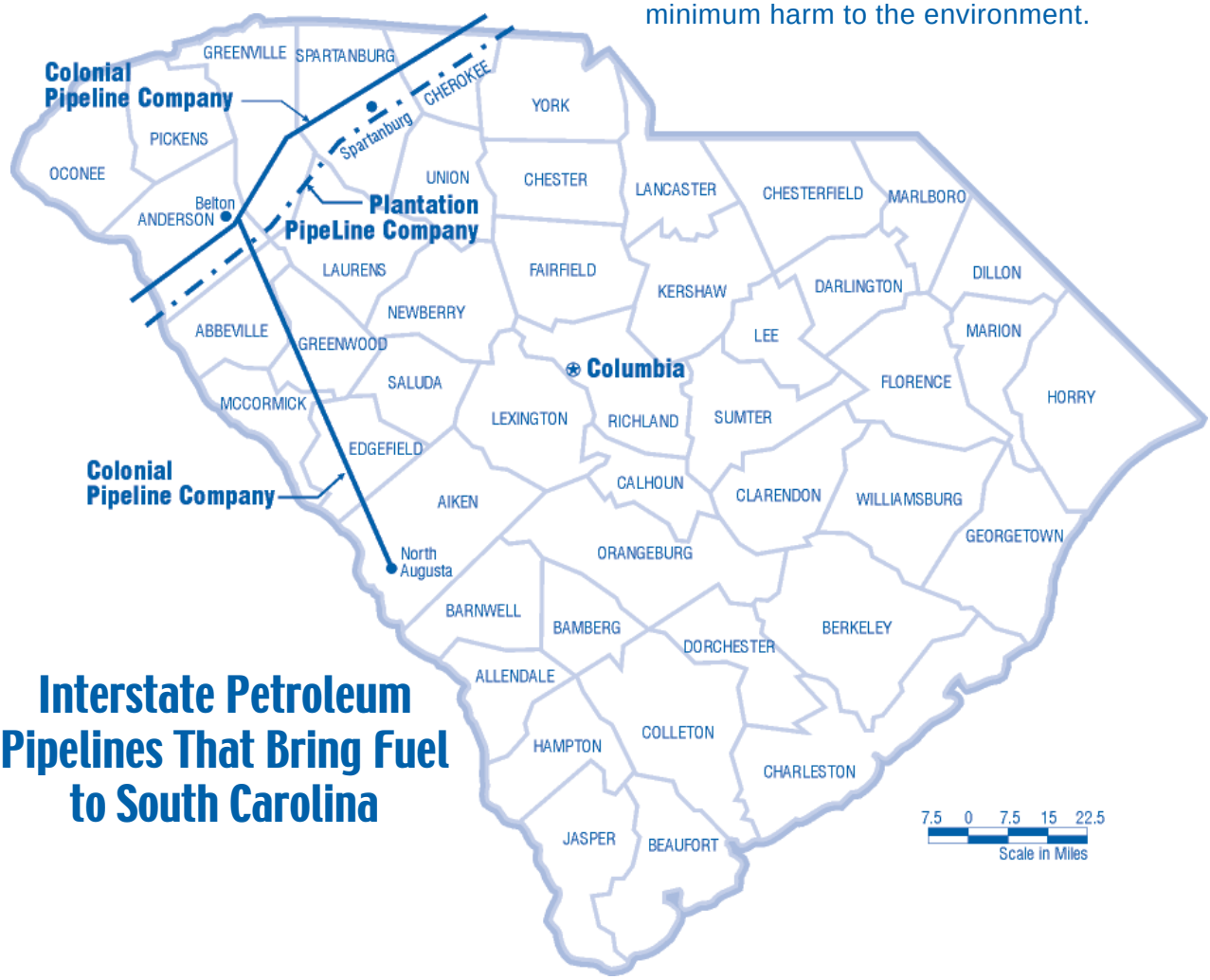
Even though 31 of the 50 states produce some crude oil, 54 percent of the oil used in the United States comes from foreign countries. Much of this imported oil comes to the United States from the Middle East.

Like the rest of the Eastern seaboard, South Carolina imports most of its crude oil from overseas. The crude oil is brought to refineries on the Gulf Coast before being transported to the United States. Two major pipeline companies, the Colonial Pipeline Company and the Plantation Pipeline Company, transport petroleum directly to us. The map below shows the routes traveled by their mostly underground pipelines. Belton and Spartanburg are the main terminal points for both the Colonial and the Plantation pipelines. Colonial also has a marketing terminal in North Augusta. From these cities, petroleum is delivered by truck throughout the state.

Natural Gas

Its Advantages and Disadvantages

Many energy experts believe natural gas is close to being a perfect fuel. Its chief advantage is that it is easy to use. Unlike crude oil which must be distilled, natural gas does not have to be refined. Moreover, burning natural gas does minimum harm to the environment.



Interstate Petroleum Pipelines That Bring Fuel to South Carolina

What, then, is the downside? The primary disadvantage is its scarcity. Natural gas is the least abundant of the fossil fuels.

Unfortunately, in the haste to obtain petroleum, drillers previously burned the natural gas that came to the surface with petroleum. Not knowing it would one day be valuable, it was thought to be less costly to burn the gas than to keep it. Today drillers know otherwise. They now capture the natural gas as it rises through the well to the ground's surface.

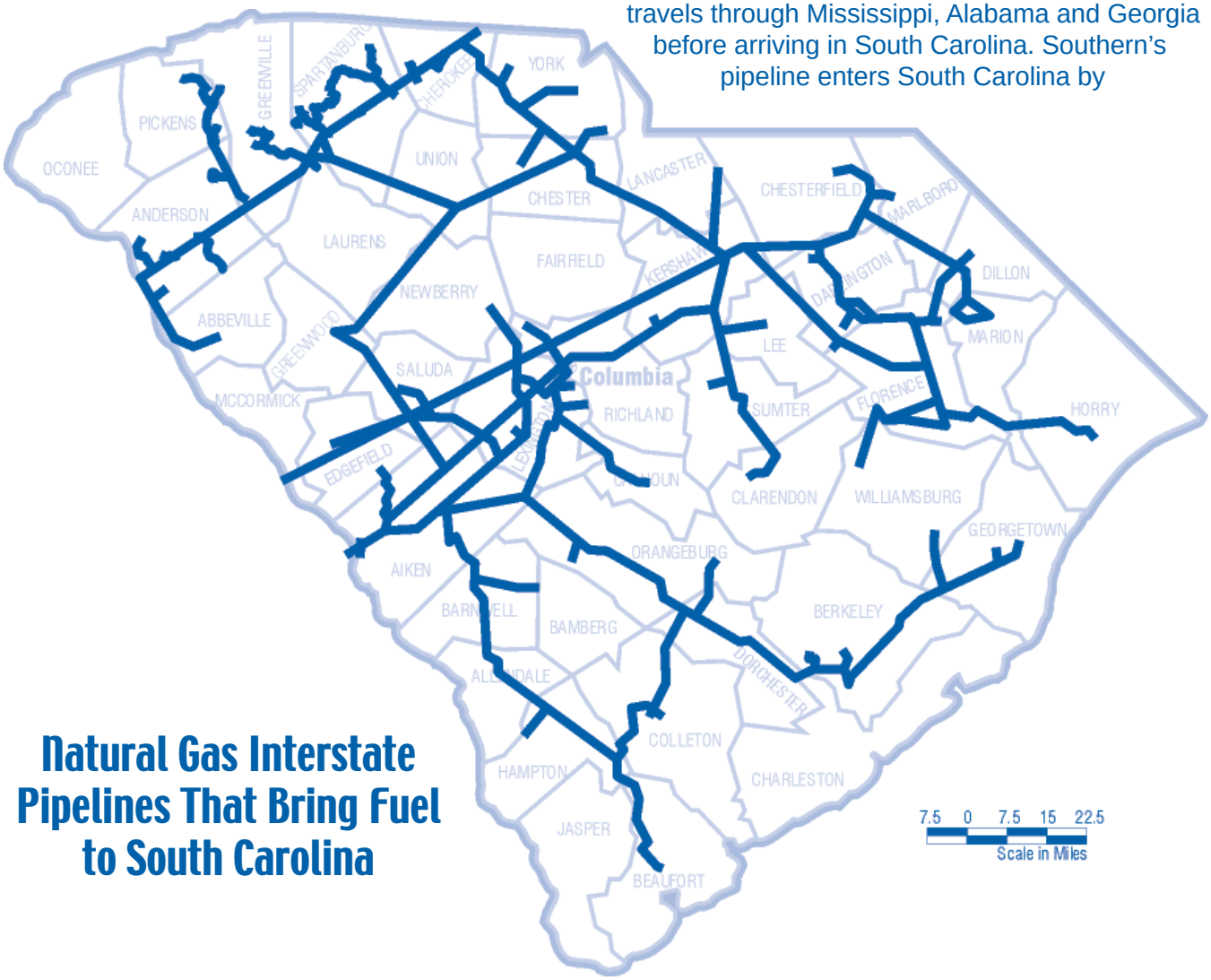
How We Get Natural Gas

Natural gas is carried away from drilling sites by large pipelines. The first natural gas pipelines used in the United States in the early 19th century were made of hollowed logs. Eventually, these were replaced by the steel and cast iron pipes used today.

Most of the natural gas used in South Carolina comes from reserves in Texas, Louisiana and the Gulf of Mexico. It is brought into the state by two major companies – the Transcontinental Gas Pipeline Company (TRANSCO) and the Southern Natural Gas Company. The map below shows where these pipelines enter the state.

The TRANSCO pipeline originates in Texas and runs through Louisiana, Mississippi, Alabama and Georgia before it reaches customers in South Carolina. Although the pipeline cannot be seen from the highway, its route parallels Interstate 85. The pipeline enters the state in Anderson County and runs for nearly 100 miles across the northwest corner of the state. The line then runs through North Carolina, Virginia, Maryland, Delaware and New Jersey before it ends in Pennsylvania.

The Southern pipeline begins in Louisiana and travels through Mississippi, Alabama and Georgia before arriving in South Carolina. Southern's pipeline enters South Carolina by



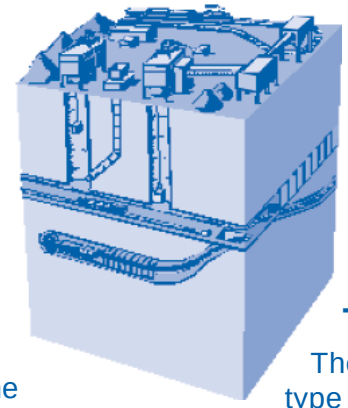
Natural Gas Interstate Pipelines That Bring Fuel to South Carolina

crossing the Savannah River near Augusta, Georgia and ends its route in Aiken.

The natural gas brought here by both TRANSCO and Southern is distributed locally by the S.C. Pipeline Corporation. More than 2,500 miles of S.C. Pipeline Corporation transmission pipelines crisscross the state, delivering natural gas to retail companies. The retailers then sell the natural gas to businesses and home customers through small distribution pipelines.

How We Use Natural Gas

Natural gas is made up almost entirely of methane. Methane is an odorless, tasteless, colorless gas. Natural gas companies add a chemical known as mercaptan – which has an unpleasant odor – to natural gas so it can be detected if there is a gas leak.



Despite being scarce, natural gas is the second most widely used energy resource. In the United States, it meets more than 25 percent of all energy needs. In South Carolina, however, natural gas usage has declined since its peak years in the early 1970s, accounting for 20.4 percent of energy consumption. Natural gas is used to cook food, dry clothes and heat water in more than 50 million American homes. Businesses and industries – ranging from restaurants to steel plants – also use natural gas to fuel their operations. Utilities burn natural gas to generate electricity.

Like petroleum, natural gas is an important fossil fuel in South Carolina's energy picture.

Coal

Coal was once the most important of all the fossil fuels. Until World War II, coal supplied about 67 percent of the nation's energy needs. It was used to warm homes, fuel trains and operate factories.

With America's growing love for the automobile, petroleum replaced steam from burning coal as our fuel of choice for transportation. Other fuels also proved to be more useful for heating and cooling. Today, coal supplies slightly less than 25 percent of U.S. energy needs – the majority of which is used in power plants to produce electricity.

What is coal?

Coal began as swamp plants living 350 million years ago. As giant ferns and mosses died and started to decay, they fell to the bottom of marshes. Eventually they formed peat – fuel that looks much like rotten wood.

Over time, heat and pressure turned peat into coal. Geologists estimate it took a layer of swamp plants 20 feet thick to form a one-foot seam of coal.

Types of Coal

There are four basic types of coal. Each type of coal corresponds to a "grade." Grades represent the amount of carbon in coal. The higher the grade, the more carbon. And the more carbon, the greater the energy in the coal.

The top grade of coal is *anthracite*. *Bituminous* coal is the second highest grade. *Subbituminous* coal, having less carbon, is a lower grade of coal than bituminous. Least rich in carbon and energy is *lignite* coal.

Where is coal found?

Coal is found throughout the world. Russia, China, Australia, India and Indonesia are especially rich with coal reserves. So too is the United States. The National Energy Foundation estimates that there may be 4 trillion tons of coal in the United States.

The vast majority of coal found in the United States is bituminous coal. Wyoming, West Virginia and Kentucky are the leading producers of bituminous coal. The only anthracite coal is in Pennsylvania. Although 36 states have some coal reserves, South Carolina does not.

How do we get coal?

Because coal is found in solid form, it must be mined rather than drilled like petroleum and natural gas. Coal is mined in two ways. Underground, or deep mining, is the traditional way of bringing coal to the surface. It is used primarily in the East. Typically, in this method, *continuous mining machines* are used to dig out the coal.

Strip, or surface mining, is the second way in which coal can be mined. Today, it is the most popular way to mine coal. In this type of mining, huge loading shovels are used to remove a layer of rock and soil known as the *overburden*. Once the overburden is removed, miners are then free to remove the exposed coal. Strip mining can only be done when the coal is buried close to the earth's surface. These types of coal reserves exist chiefly in the Western states.

Concerns for the Environment

Over time, we have learned that mining carries with it environmental responsibilities. Wastes from underground mining can pollute waters. The digging of mines can make land sink or shift. When this happens, nearby roads, sewers and buildings can collapse. Strip mining also removes ground water. This can cause wells to dry up and affects the animals and plants living in the area.

Using coal raises other concerns. Burning coal can pollute the atmosphere. Two major threats to our environment — acid rain[1] and global warming[2] — are thought to be aggravated by burning coal.

To combat these threats to the environment, a number of federal laws have been passed. Strip mines, for example, by law, must be returned to their original condition. Moreover, since 1970, the Clean Air Act (and all its amendments) has required heavy coal users to lower their levels of pollution. By installing scrubbers, industrial plants and public utilities have dramatically lowered the levels of sulfur released by burning coal. In addition, new sources of low sulfur coal have been located for use by industry and utilities. Pollution has been further held in check by the use of precipitators that remove polluting fly ash from the air. Like sulfur, fly ash is released into the atmosphere by burning coal. By reducing both sulfur and fly ash, the environment is made cleaner.

How We Use Coal

The chief use of coal today is in the production of electricity. In South Carolina, more than 42 percent of all the electrical plants are operated by coal, as compared to more than 56 percent in the United States. Many South Carolina industries also use coal to run factories. Very small amounts of coal are used by South Carolina's residential and commercial sectors. The transportation sector, however, stopped using coal in 1977. The coal-fired locomotive is now a relic of our past.

Conclusion

Fossil fuels are very much a part of our energy lives. Although South Carolina is somewhat less dependent on fossil fuels than other states, the state still relies on petroleum, natural gas and coal to meet most of our energy needs.

Since fossil fuel supplies are limited, future energy needs should be considered now. What can Americans do to ensure that the nation has the energy it needs? Two strategies offer hope. First, we can learn to not waste energy. Second, we can look for ways to replace fossil fuels with other resources. America's energy future rests on being wise consumers.

1. When coal is burned, sulfur in the coal combines with oxygen in the air to form sulfur dioxide. Sulfur dioxide is thought to be the principal cause of acid rain. As its name implies, acid rain is precipitation that has an unusually high acidity. The acid in this rain (or snow, fog, hail or dew) causes buildings and roads to erode.

2. Burning coal also releases carbon dioxide into the air. Increased carbon dioxide is believed to keep heat trapped within the Earth's atmosphere. This causes the climate to get continually warmer, a condition known as global warning.